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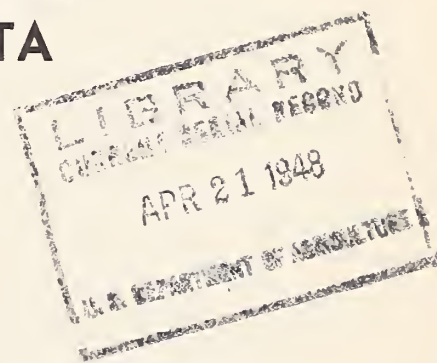
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UNITED STATES DEPARTMENT OF AGRICULTURE  
BUREAU OF AGRICULTURAL ECONOMICS

# HARVESTING NATIVE HAY *in the* MOUSE RIVER VALLEY OF NORTH DAKOTA



*by*  
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## CONTENTS

	<u>Page</u>
Introduction . . . . .	1
Introduction of mechanical power . . . . .	2
Power by horses . . . . .	2
Mechanical power . . . . .	2
Mechanization, present and future . . . . .	3
Duty rates of machines . . . . .	4
Duty rate of stacking crews . . . . .	5
Effects of mechanization . . . . .	6
Labor requirements per acre and per ton . . . . .	6
Time saved in mowing and raking . . . . .	7
Time saved in stacking . . . . .	9
Stacking season shorter . . . . .	10
Proportion of labor hired . . . . .	10
Machinery costs . . . . .	11
Future progress . . . . .	13

## INTRODUCTION

During the last 30 years mechanical power on farms has gradually been replacing horses. Perhaps the first job to be undertaken by mechanical power was plowing. As tractors were improved in adaptability and efficiency, mechanical power displaced horses in other field operations. In recent years mechanical power has invaded the hay field and the various haymaking jobs long performed by horses are now being mechanized. Tractor mowers and power-bucks are conspicuous in most large hay fields and hay choppers, hydraulic buck-stackers and automatic pick-up balers have recently appeared on the scene.

- Introduction of these machines involves questions concerning their adaptability in performing the haymaking operations involved, the saving in man-labor anticipated, the cost of the mechanical methods compared with horse-power methods, the effect upon the feed value and the keeping quality of the hay, and the relationship of the modernized methods to the organization and management of farms and ranches.

The study of haymaking in McHenry County, N. Dak. was part of a Nation-wide study of hay-harvesting practices, the primary objective of which was analysis of haymaking methods, both new and old. The information



was obtained in 1945 by interview from 28 operators, mostly ranchers who were located in the vicinity of the Mouse River. This report describes the introduction of mechanical power in haymaking on these ranches, and its effect upon systems of haymaking, the amount of labor required in putting up hay, and the length of the haymaking season. The report also throws some light upon future developments and the possible effects of these upon the systems of haymaking in this area.

## INTRODUCTION OF MECHANICAL POWER

Power by horses.- Ranchers in the Mouse River Valley used horses for power exclusively in putting up hay until rather recently when mechanical power came into use. The equipment consisted of mowers, dump rakes, sweep rakes, and overshot stackers. The hay was stacked in the meadow in summer and hauled into the feed yard in the fall and winter months by wagon or bobsled. The size of the haying crew varied with the quantity of hay to be put up and the manpower available. Small outfits first mowed and raked hay into the windrow, then delayed further moving until this hay was in the stack. Large outfits used a crew large enough to permit simultaneous performance of cutting, raking, and stacking. The mowing and raking operations were performed in the conventional manner, using 5- and 6-foot mowers and 10- and 12-foot dump rakes.

In stacking, the hay was taken from the windrow with a sweep rake and thrown into the stack by the overshot stacker. A stacking frame was used on two and sometimes on four sides of the stack, thus making it easier to build. Although the size of the stacking crew varied considerably among ranches a standard crew for reasonably large meadows consisted of two horse-drawn sweep rakes and an overshot stacker, with a team of horses for power. Two men drove the sweep teams, one man drove the stacker team, and there were two men in the stack. This outfit required five men and six horses unless a scatter rake and fork tender were needed where the meadow was rough. In this case two men and two horses were added. Smaller crews operated with one sweep and one man in the stack and larger crews occasionally added a third sweep as well as an extra man on the stack.

This method of hay harvesting was well adapted to the large meadows in the flood plain of the Mouse River and everything considered, it was effective. This is evident from the fact that thus far mechanization of haymaking in this area has largely involved substitution of mechanical power for horses within the method just described rather than substitution of a completely new method. However, future development in mechanization may bring more drastic changes.

Mechanical power.- Although one of the ranches studied used a tractor mower as early as 1935 and another used a "home-built" autobuck in 1938, mechanical power was not extensively used until 1940 (table 1). However, the superiority of mechanical power was quickly recognized. The rubber-tired tractor with a power take-off mower can cut as much hay in a day as three horse mowers. The autobuck or tractor buck equals two horse sweeps in performance. Once mechanical power entered the picture,

its use for additional operations developed rapidly. Motor trucks and tractors were soon used to replace the team on the overshot stacker, to rake hay into the windrow, and to haul hay from the meadow to the feed yard in the fall and winter. Ranchers hauling hay from distant meadows recognized the superiority of mechanical power for long hauls. Special-built truck and tractor trailers were devised and large loads of hay were moved quickly over long distances. Other devices for moving large quantities of hay from meadow to feed yard include a hay sled and a giant buck rake, each capable of moving a whole stack (6 to 8 tons) in one load.

Table 1.- Tractors, tractor mowers, and power bucks on 31 ranches, by year of purchase, McHenry County, North Dakota, 1945

Year of purchase :	Tractors :		Tractor mowers :		Power bucks :	
	Number	Percent	Number	Percent	Number	Percent
Before 1940	6	25	4	18	1	9
1940	8	33	8	36	1	9
1941	3	13	3	14	0	---
1942	1	4	1	5	3	27
1943	1	4	2	9	4	37
1944	3	13	2	9	1	9
1945	2	8	2	9	1	9
Total	24	100	22	100	11	100

Recently, new attachments for tractors are threatening to replace the overshot stacking outfit which has so long been considered standard equipment in the Mouse River area. The jayhawk stacker with a mechanical lift and the hydraulic buck-stacker each do the work of sweep rakes, overshot stacker, and stacker-frame combined. Use of this new equipment saves moving the stacker and frame from place to place in the meadow or between meadows. Considerable saving in size of crew is also possible. However, the overshot stacking method with mechanized power has many arguments in its favor and the new devices must prove their superiority before they can replace it.

Mechanization, present and future.- Mechanization has been adopted rapidly. In 1945, 77 percent of the ranchers interviewed were using tractors in putting up hay; 71 percent had tractor mowers and 35 percent used tractors on dump rakes; one-third had power buckrakes; and one rancher was using a hydraulic buck-stacker (table 2).

Further progress in mechanization in the future is indicated by the fact that two of the ranchers who did not have a tractor intend to buy one in the future; four intend to buy tractor mowers; six, now using horse sweeps, plan to obtain power sweeps; and four intend to buy hydraulic buck-stackers. If these intentions materialize, 84 percent of the ranchers

interviewed will have tractors and tractor mowers; 55 percent will have power sweeps; and 16 percent will have hydraulic buck-stackers (table 2).

Table 2.- Ranchers having specified mechanized equipment in 1945 and intended purchases of additional equipment, 31 ranches, McHenry County, North Dakota

Kind of equipment	Ranchers having in 1945		Number of ranchers intending to buy		Percentage of ranchers who will have in the future 1/	
	Number	Percent	Number	Percent		
Tractors	24	77	2		84	
Tractor mowers	22	71	4		84	
Tractor dump rakes	11	35	---		---	
Power sweeps	11	35	6		55	
Hydraulic buck-stacker	1	3	4		16	

1/ Assuming that intentions to buy materialize.

Duty rates of machines.- Tractor mowers, rakes, and sweeps have an advantage over horse-drawn equipment in acres covered per hour or tons of hay moved, which is one reason for their rapid adoption in this area, (table 3). A tractor mower covers nearly three times as many acres per hour as a horse mower. One power sweep moves nearly as much hay as two

Table 3.- Duty rates of specified equipment on ranches in McHenry County, North Dakota, 1945

Kind of equipment	Size	Number of operators reporting	Acres or tons per hour	
			Average	Range
Mowers				
Horse-drawn	5-6 ft.	8	1.1 (acres)	.8-1.9 acres
Tractor	7 ft.	18	3.2 (acres)	1.8-4.0 acres
Sweep rakes				
Horse-drawn		17	2.5 (tons)	1.4-5.0 tons
Power		7	4.6 (tons)	2.5-6.3 tons
Dump rakes				
Horse-drawn	10-12 ft.	16	2.6 (acres)	1.5-4.0 acres
Tractor power	10-12 ft.	6	3.8 (acres)	1.8-5.0 acres



horse sweeps and tractor power on the dump rake is 50 percent faster than horse power. The performance of the hydraulic buck-stacker was observed on only one ranch, hence authentic duty rates are not available for this machine. However, general observation indicates that the performance rate of this machine in stacking hay is high compared with the overshot stacking method.

Duty rate of stacking crews.- The size and composition of stacking crews under different degrees of mechanization (table 4) varied little between the groups of ranches representing each. This was probably due to the wide range between individual ranches in size of crew in each of these

Table 4.- Crew rates in stacking hay with different degrees of mechanization

Item	Overshot stacking method						
	Sweeps operated with			Overshot stacker			Hy-
				operated with			draulic
	Horses	Mixed power	Mechanical power	Horses	Mechanical power	buck-stacker	
Number of ranches	17	28	7	1	1	1	
Av. size of crew							
Men	3.9	3.9	3.9	4	3	2	
Horses	5.5	4.1	1.1	6	0	0	
Tractors	.2	.6	1/ 1.3	0	1	1	
Trucks	.1	.1	.3	0	1	0	
Av. tonnage stacked per hour	4.2	4.5	4.6	5	5	7	
Range in tonnage stacked per hour	1.43-10.00	1.38-10.00	2.50-6.25	---	---	---	
Av. tonnage stacked per man-hour	1.03 T.	1.16 T.	1.24 T.	1.25 T.	1.67 T.	3.57 T.	

1/ Six operators had 1 tractor or buck rake and one operator had 3 tractors.

groups. On the individual ranches in the table the reduction in size of crew with increasing mechanization is more evident. The tonnage stacked per hour rises moderately with increasing mechanization and the tonnage stacked per man-hour is more pronounced. In the group of 7 ranches which used power sweeps 20 percent more hay was stacked per man-hour than was stacked in the group of 17 ranches when horse power was used on the sweeps. The difference in tonnage stacked per man-hour was even greater on the individual ranches. The hydraulic buck-stacker outfit put up 185 percent more hay per man-hour than did the horse-drawn outfit.

## EFFECTS OF MECHANIZATION

Apparently, mechanical power and equipment are swiftly replacing horses and horse-drawn equipment in Mouse River hay fields. The advantages of this change are apparent, yet it seems desirable to appraise its effects upon ranch operation.

Mechanization of any farm or ranch operation involves substitution of a machine or mechanical power or both for manpower, horse power or both. In the Mouse River Valley the advancement in mechanization of hay-making thus far has involved substitution of truck and tractor power for horses. The new machines introduced were the power-take-off mower, the jay-hawk stacker, the hydraulic buck-stacker and several devices for hauling hay from the stack to the feedlot. In practically every case mechanization increased the speed of performance of the operation involved and made the work easier for the man who operated the machine. Mowing and raking with tractor power required less time than with horses for power. The effect of increased mechanization on the stacking operation was to increase the tonnage of hay which could be stacked daily by a given crew of men or to reduce the size of the crew required to stack the same amount as formerly. The adjustment varied considerably among individual ranches. Consequently, the effect of mechanization in the area studied is reflected partly in smaller haying crews and partly in a shorter haying season. The man-labor required per ton and per acre has been reduced and the proportion of labor hired in haying is slightly less.

Labor requirements per acre and per ton.- The effect of mechanization upon the man-labor required per acre is roughly indicated by a comparison of the labor requirements on ranches which use horses exclusively, with labor required on ranches using mechanical power exclusively, and the entire group of ranches which represents a mixture of horse power and mechanical power (table 5). This indicates that the average amount of man-labor per acre on all ranches studied was 26 percent less than it was on the 17 ranches which used only horses for power. Complete substitution of mechanical power apparently promises still greater reduction in the man-labor required, if the average performance of 7 ranches is considered roughly indicative. On these ranches the man-labor required per acre was 34 percent less than on ranches which used horses for power exclusively. The effect of mechanization upon the labor requirements per ton is even more pronounced. The greatest reduction in man-labor per acre and per ton was in mowing and raking. Little time was saved in stacking.

The more extreme effect of mechanization on the labor required on individual ranches is indicated in the comparison of labor requirements on three selected ranches (table 6). The first of these used horses for power exclusively and the performance is above the average of ranchers using this kind of power. The second ranch used mechanical power for all haying operations and has an efficient operator. The third had substituted the hydraulic buck-stacker for the overshot stacker. The yield of hay per acre varied considerably on these three ranches. The effect of this upon labor requirements per acre and per ton must be recognized in comparing the labor requirements. The performance on these three individual ranches

Table 5.- Varying degrees of mechanization of overshot stackers and man-labor requirements per acre and per ton of hay, McHenry County, North Dakota, 1945

Item	Man labor per acre, with			Man labor per ton, with		
	Horse-drawn	Mixed horse and mechanical	Mechanical power used exclusively except on stackers	Horse-drawn	Mixed horse and mechanical	Mechanical power used exclusively except on stackers
Number of ranches	17	28	7	17	28	7
Yield per A. (T.)	1.09	1.20	1.20	1.09	1.20	1.20
Mowing (M.H.) 1/	0.87	0.35	0.30	0.80	0.29	0.25
Raking (M.H.) 1/	0.39	0.34	0.26	0.36	0.28	0.22
Stacking (M.H.)	1.06	1.03	0.97	0.97	0.86	0.81
Total M. H.	2.32	1.72	1.53	2.13	1.43	1.28
Man-labor saved:						
Hours		0.60	0.79		0.70	0.85
Percent		26	34		33	40

1/ Of the 17 ranches using horses in stacking, only 6 used horse-drawn mowers and 12 used horse-drawn dump rakes. Duty rates used in this calculation were those of horse-powered outfits only.

is not comparable with the group averages, but it is roughly comparable between individual ranches as each represents highly efficient performance in the method used.

Sixty-four percent less man-labor was required per acre on the ranch where mechanical power was used on all operations in the overshot stacking method as compared with the ranch where only horses were used. On the ranch where the hydraulic buck-stacker was substituted for the overshot stacker, the reduction in labor requirements was even greater (table 6). On a per ton basis the ranch using the overshot stacking method with mechanical power required 14 percent less man-labor than did the ranch on which horses were used, but the rancher using the hydraulic buck-stacker required 58 percent less labor. Though these ranches do not represent average performance which may be expected from the methods described they do indicate some of the possibilities of future advances in mechanization of haymaking.

Time saved in mowing and raking.- The most striking contrast between horse and tractor power is in mowing and raking (table 7). The average acreage of hay mowed per ranch, 493 acres, would require nearly 43 days of



Table 6.- Man labor requirements per acre and per ton on three ranches with different degrees of mechanization, McHenry County, North Dakota, 1945

Item	Requirements per acre			Requirements per ton		
	Overshot	stacker	Hydrau- lic Mechan- ical stacker	Overshot	stacker	Hydrau- lic Mechan- ical stacker
	Horses on all opera- tions	power on all opera- tions	and mechan- ical power	Horses on all opera- tions	power on all opera- tions	and mechan- ical power
Number of ranches	1	1	1	1	1	1
Yield per A.-tons	2.4	1.0	1.8	2.4	1.0	1.8
Mowing (Man-hrs.)	.83	.33	.25	.35	.33	.14
Raking (Man-hrs.)	.40	.20	.25	.17	.20	.14
Stacking (Man hrs.)	1.92	.60	.50	.80	.60	.28
Total man-hours	3.15	1.13	1.00	1.32	1.13	.56
Man-labor saved:						
Hours		2.02	2.15		.19	.76
Percent		64	68		14	58

Table 7.- Time saved in mowing and raking 493 acres by mechanical power compared with horse-drawn machinery 1/

Item	Mowing		Raking	
	Horse power 2/	Tractor power 3/	Horse power	Tractor power
Total acres covered	493	493	493	493
Acres per 10-hour day	11.5	32.1	26.0	38.0
Total number of days required	42.9	15.4	19.0	13.0
Days saved:				
Number		27.5		6.0
Percent		64.0		32.0

1/ This was the average acreage of hay per ranch on the 28 units studied in McHenry County in 1945.

2/ Size 6 ft.

3/ Size 7 ft.



work with a horse mower compared with about 15 days with a tractor mower, a saving of 27 man-days - more than a month's working time. One tractor mower can do the work of approximately three horse mowers. In raking, the contrast is less pronounced, largely because the dump rakes used had not been adapted to the full capacity of the tractor from the viewpoint of either power or speed. The rakes studied were old horse-drawn outfits which were hitched behind the tractor. In few cases was more than one rake used per tractor. In spite of these handicaps, raking with tractor power was one-third faster than with horse power. On the average of the ranches studied 6 days could be saved by using tractor power on the rake. Using mechanical power for both mowing and raking would reduce the man-labor required for these operations by more than half, compared with the horse-power method.

Time saved in stacking.- To stack the average tonnage of hay per ranch (574 tons) by the overshot stacker method would require nearly 56 man-days using horses, compared with 46 days, if mechanical power were used (table 8). This represents a saving of 17 percent. Although this

Table 8.- Man labor required to stack 574 1/ tons of hay with different degrees of mechanization, McHenry County, North Dakota, 1945

Item	:Av. performance per ::			:Individual ranchers using ::		
	: ranch using ::			: method of stacking ::		
	:overshot stacker and ::			: indicated ::		
	: power indicated ::			: indicated ::		
	: ::			:Overshot: ::		
	: ::			:Overshot:stacker :Hydrau- ::		
	:Horse :Mixed :Mechan- ::			:stacker : with : lic ::		
	: ::			: with : mechan- : buck- ::		
	: ::			:horses : ical : stacker ::		
	: ::			: power : ::		
Number of operators	: 17	: 28	: 7	:: 1	: 1	: 1
Tons stacked per ranch	: 574	: 574	: 574	:: 574	: 574	: 574
Av. man-days stacking per ranch (10-hour days)	: 55.7	: 49.5	: 46.3	:: 45.9	: 34.4	: 16.1
Man labor saved:	:	:	:	::	:	:
Number of days 2/	:	: 6.2	: 9.4	::	: 11.5	: 29.8
Percent	:	: 11	: 17	::	: 25	: 65

1/ This is the average quantity of hay put up on the 28 ranches studied in 1945.

2/ Compared with the time required by the horse-power method shown in columns 1 and 4.

is less than the proportionate saving in mowing and raking it is nevertheless worthy of consideration. On the individual ranches where performance was above average, the fully mechanized crew would use 25 percent less man-labor than the horse-powered outfit in stacking 574 tons of hay, and the crew with the hydraulic buck-stacker would use 65 percent less.

Stacking season shorter.- The effect of mechanization on the length of the stacking season is moderate (table 9). If the average of the seven most highly mechanized outfits may be considered indicative, a reduction of 9 percent is possible. Substitution of the hydraulic buck-stacker for the overshot stacker could shorten the stacking season considerably. However, a similar result may be achieved by adjusting the size of the crew used in the overshot method.

Table 9.- Number of stacking days required to put up 574 tons <sup>1/</sup> of hay with different degrees of mechanization, McHenry County, North Dakota, 1945

Item	Overshot stacking method					
	Sweeps operated with			Overshot stacker		
	operated with			Hydraulic buck-stacker		
	Horses	Mixed power	Mechanical power	Horses	Mechanical power	Hydraulic buck-stacker
	2/	3/	4/	5/	5/	5/
Number of men in crew	3.9	3.9	3.9	4	3	2
Number of tons stacked	574	574	574	574	574	574
Number of tons stacked per hour	4.2	4.5	4.6	5.0	5.0	7.0
Number of stacking days	13.6	12.8	12.4	11.5	11.5	8.2
Stacking days saved:						
Number		0.8	1.2	2.1	2.1	5.4
Percent		6	9	15	15	40

- 1/ The average tonnage of hay put up on the 28 ranches and farms studied.  
2/ Based on average performance on 17 ranches.  
3/ Based on average performance on 28 ranches.  
4/ Based on average performance on 7 ranches.  
5/ Based on performance of one ranch in each case.

Proportion of labor hired.- Substitution of machines and mechanical power for manpower should reduce the labor force, especially the hired labor. The proportion of labor hired in stacking hay under three levels of mechanization in the Mouse River Valley indicates a tendency to reduce the proportion of hired labor as mechanization increases (table 10). Eleven operators who used mechanical power on buck rakes hired on the average only a third of their crew, whereas in the group of 17 operators who used horses nearly half the crew was hired. It seems obvious that substitution of the hydraulic buck-stacker for the overshot stacker would facilitate even greater reduction in hired labor, as further reduction could be made in the size of crew.

On the 28 ranches studied, 47 men were hired to stack hay. If mechanical power had been used in every case in the stacking operation

Table 10.- Proportion of labor hired in stacking hay under different degrees of mechanization in McHenry County, North Dakota, 1945

Kind of power used on sweeps	Number of ranches	Proportion of haying crew hired
		Percent
Horses	17	49
Mixed (Horses and mechanical)	28	42
Mechanical	11	33

the number of workers hired could have been reduced to 26  $\frac{1}{2}$ , a reduction of 45 percent. If the hydraulic buck-stacker had been used on each ranch in place of the overshot stacker only 10 hired hands would have been needed in stacking hay on the 28 ranches. From the cost standpoint it would not be practicable for all of the ranches to invest in hydraulic buck-stackers, but many could and a number intend to do so.

Machinery costs.- In this analysis the effects of mechanization have been measured almost exclusively in terms of reduction in the man-labor requirements. Obviously the cost of increased mechanization should be considered in relation to the labor saved. This consideration has been omitted, thus far, because accurate information on costs was not available. However, the ranch operator who is considering purchase of new machines will wish to weigh the cost of these, both in terms of investment and operating cost, against the benefits anticipated from the use of the new machines. He will probably also consider the effect of the machine upon the timeliness of performance of haying operations as well as the relief it brings from tasks which formerly required hard physical labor.

Although cost information is not available in full detail some light can be thrown on comparative costs. The investment in equipment other than power, amount and kind of power required, and the number of men required for the haymaking crew are indicative of some of the costs involved (table 11).

The overshot method using horses requires an investment of approximately \$375 at present prices for equipment other than power. This compares with \$300 invested in equipment other than power when mechanical power is used. The fact that one power sweep will replace two horse

1/ In calculating the change, the family labor force was left unchanged. Sufficient hired labor was retained to provide an adequate crew for a mechanized stacking outfit on each ranch. On this basis the number of hired hands needed on the 28 ranches would have been 26 compared with 47 actually used in 1945.



sweeps accounts for this difference. The hydraulic buck-stacker replaces the overshot stacker, the stacker frame, and the sweep rakes, at an added investment cost of \$20. Roughly speaking, the difference in the investment in equipment other than power is not significant under the three methods described in table 11.

Table 11.- Comparison of three methods of stacking hay, developed from study of 28 ranches in McHenry County, North Dakota, 1945

Item	Overshot-stacker method with		Hydraulic buck- stacker method
	Horses	Mechanical power	Tractor power
Investment in equipment <sup>1/</sup>			
Overshot stacker	\$ 190	\$ 190	---
Sweeps			
Horse-drawn, 2 sweeps	160		
Tractor power, 1 sweep		85	
Stacking frame (one side)	25	25	
Hydraulic buck-stacker			\$ 395
Total	\$ 375	\$ 300	\$ 395
Power used:			
On sweeps	4 horses	1 tractor	
On stacker	2 horses	1 truck	
On hydraulic buck-stacker	---	---	1 tractor
Number of men in crew:			
On sweeps	2	1	0
In stack	2	2	2
Driving stacker power	1	1	0
Driving hydraulic buck-stacker			1
Total	5	4	3

<sup>1/</sup> Other than power.

The most expensive power unit is required for the mechanized overshot-stacker method, second highest for the hydraulic buck-stacker system, and least for the horse-powered overshot method. This immediately raises a question about other uses which the ranches may have for a tractor and a motor truck. The problem involves the choice among horses, tractors, and trucks as sources of power for all the jobs which are performed rather than a choice of type of power for the hay stacking operation alone.

Perhaps the primary use of a truck would be hauling livestock to market, supplies to the ranch, or hay from distant meadows. If so, the additional use of the truck as power on the overshot stacker would add



only a small additional cost to the hay-stacking operation. Likewise, on large ranches the tractor has many uses other than stacking hay, such as mowing, raking, and sometimes hauling hay and manure. These other uses would help to justify the additional investment in the tractor. On ranches where cultivated crops are grown for feed or cash sale the superiority of the tractor for the heavy field operations would help further to justify the extra investment in the tractor.

The horse-drawn outfit requires a crew of five men. As substitution of mechanical power eliminates one sweep rake, the crew is reduced by one man without reducing the tonnage of hay stacked per day. This represents a 20 percent reduction in man-labor. When the hydraulic buck-stacker is used the crew is reduced to three men. This crew should stack at least as much hay as the larger crews employed in the overshot stacker method. The reduction of 40 percent in the size of the crew compared with the horse-powered method should be considered when comparing costs. Furthermore, when the hydraulic method is used there is no stacker or stacker frame to be moved from one stacking location to another or between meadows. This saves considerable time and trouble.

#### FUTURE PROGRESS

Progress thus far in mechanization of hay-harvesting operations in this area involves largely the substitution of mechanical power for horses on mowers, dump rakes, sweep rakes, and overshot stackers. Introduction of the power-take-off mower and special built power sweeps (power bucks) has accompanied this development. Intentions of ranchers to buy new equipment indicate that the power mower will soon be universally adopted and that a large proportion of ranchers will use mechanical power on dump rakes, sweep rakes, and overshot stackers. These intended developments indicate that mechanical power may soon replace horses in these operations. The superiority of mechanical power seems to have been well demonstrated. Although much hay is now being hauled from the meadow to the feed yard by mechanical power, a complete substitution of mechanical power in this operation is still somewhat questionable because of difficulty with deep snow during the winter season. Moving hay to the feed yard in the early fall may be a partial solution. This would avoid the difficulty of hauling hay from a distance when snow cover is heavy. Use of mechanical power would facilitate this change in practice as hay could be moved from distant meadows in less time than is required with horse-drawn machinery.

The future of some of the new methods of handling hay is more difficult to foresee. Will the hydraulic buck-stacker replace the overshot stacker? In 1945, local opinion on this point was divided. Ranchers who had used the overshot stacker for a long time doubted the superiority of the hydraulic buck-stacker. Those favoring the hydraulic buck-stacker indicated that in their opinion its substitution for the overshot stacker was "just a matter of time". Obviously, this method makes possible a considerable saving in man labor through reduction in the size of crew required in stacking hay. Furthermore, the hydraulic buck-stacker replaces the overshot stacker, stacker frame, and sweep rakes. As practically all

ranchers have, or soon will have, a tractor, the introduction of the hydraulic buck-stacker will become increasingly more convenient and less costly.

Another new method for handling hay is field chopping. One of the ranchers interviewed was using this method for handling his alfalfa for the second consecutive season. Thus far this method seemed satisfactory. Is this practice likely to be adopted by other ranchers in the neighborhood? Will it prove successful in handling native hay or is it adapted only to tame hay? Although little information on this method could be obtained in the Mouse River Valley in 1945, considerable information is available from tame-hay areas in Colorado and Nebraska. The use of the field-chopping method in these areas eliminates some of the operations requiring hard physical labor. Also, considerably less labor is required than when hay is handled loose. The effect of field chopping on the feeding value of alfalfa hay is favorable in the opinion of farmers who have used it. This point needs further investigation, however. Not to be forgotten is the price of field choppers and blowers which must be bought by operators who wish to adopt this method of handling their hay.

The automatic pick-up baler operated by one man is another new machine which may have to be taken into consideration in the future. As none of these machines were found in the area surveyed, no information is available on the advantages of this method compared with methods now in use. Sheer speculation suggests that, in some instances, baling the hay might facilitate concentration in close proximity to the winter feed yard. This assumes that trucks would be available for hauling and that mechanical unloading equipment could be used in stacking the bales, so that the baled hay could be moved quickly before snow interferes.



